SECTION 16760

SCADA SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers requirements for the Supervisory Control and Data Acquisition (SCADA) System for the Sutter Bypass – Control System Rehabilitation Project which includes the following sites:

1. Sutter Maintenance Yard (SMY).
2. Pumping Plant No. 1 (PP1).
3. Pumping Plant No. 2 (PP2).
4. Pumping Plant No. 3 (PP3).

B. The SCADA System shall be a complete integrated system with the Metal-Enclosed Switchgear, Relays, Instrumentation, Programmable Logic Controllers, Diesel Engine Generators, Automatic Transfer Switches, Existing Water Level Measurement Equipment and Communications System.

C. The contract item SCADA System includes furnishing and installing SCADA System Equipment and Software at the Sutter Maintenance Yard, PP1, PP2, and PP3 to include:

1. SCADA Workstation.
2. Laptop
3. SCADA Server.
4. Historical Data System (HDS).
5. SCADA System and Software.

D. The Contractor shall assume responsibility for the provision and performance of the complete integrated control system. The SCADA System shall be a Turnkey Solution that meets the design intent.

1.02 RELATED SECTIONS

A. Supplementary General Conditions, General Conditions, Division 1 sections, and Drawings apply to this section. This section may require direct correlation with the following sections of the contract:

1. Section 13420 – Level Sensors.
2. Section 16050 – Basic Electrical Materials and Methods.
3. Section 16080 – Electrical Testing.
4. Section 16120 – Insulated Wire and Cable.
5. Section 16230 – Diesel Engine Generator.
6. Section 16415 – Switches and Load Banks.
7. Section 16430 – Metal-Enclosed Switchgear.
8. Section 16720 – Communications Equipment.
9. Section 16921 – Prefabricated Control Buildings.
10. Section 16940 – Training Programs.

1.03 REFERENCES

A. The following publications form a part of this specification to the extent referenced. Application of these publications shall conform to Document 00702 – Interpretation of the Contract, Paragraph 2:

1. American National Standards Institute (ANSI).
2. Electronic Industries Association/Telecommunications Industry of America (EIA/TIA).
3. Telcordia General Requirements (GR) -1089 Core.
4. Institute of Electrical and Electronic Engineers (IEEE).
5. California Electrical Code (CEC).
6. National Electrical Code (NEC).
7. National Electrical Safety Code (NESC).
8. Electronic Institute of America (EIA).

9. Underwriters Laboratories Inc. (UL).

1.04 SUBMITTALS

A. The Contractor shall submit the following:

1. Catalog cuts sheets.

2. System Software, Operating Systems, and supporting software.

3. The Plant Model: The logical representation of the physical processes being controlled and supervised.

4. SCADA System Screen Navigation Maps.

5. Installation drawings to include:

a. Connection Diagrams.

b. Ladder Logic Diagrams.

c. Plan and elevation views.

d. Wiring Diagram.

e. Functional Block Diagram.

f. Interface, Graphic User Interface (GUI).

g. Programming.

h. Menu Navigation Charts.

6. Installation Instructions:

a. Hardware Installation.

b. Software Installation.

7. Test plans:

a. Shop Tests.

b. Commissioning Tests.

c. Site Acceptance Tests.

8. Troubleshooting procedures and solutions.

9. Operation and Maintenance instructions.

10. Test reports:

    a. Commissioning Tests.

    b. Site Acceptance Tests.

1.05 SPARE PARTS AND TOOLS

A. The Contractor shall furnish one spare fully configured SCADA workstation and server of each type provided.

1.06 DESIGN CRITERIA

A. General: The Supervisory Control and Data Acquisition System (SCADA) shall operate as a stand-alone, autonomous system, continuously monitoring sensors, monitoring Numerical Multifunction Relays (NMFRs) and Programmable Logic Controllers (PLCs), displaying data, passing data controlling motors, activating alarms and logging information to facilitate and optimize the plant processes and on-going operations. It shall be capable of polling, transmitting and receiving data, both analog and digital, at high rates of speed over the communications system, using secure digitizing protocols and error avoidance methods.

B. The SCADA System shall interface with the Communication System specified in Section 16720 – Communication System.

    1. This communication system consists of a Very Small Aperture Terminal (VSAT) primary link and a cellular modem as the secondary link. Service is provided by Verizon.

C. The SCADA System shall be required to interface with the existing network(s) and be capable of exchanging data.

    1. Data is collected at each pumping plant for The California Data Exchange Center (CDEC). The CDEC collects, stores, disseminates, and exchanges hydro meteorological data and related information. This data shall be sent back to SMY over the SCADA System and forwarded to CDEC. Data shall be collected through a parallel connection to the existing connection. The existing connection shall be maintained.

    2. Two other existing networks at the Sutter Maintenance Yard.

D. The SCADA System shall provide remote pump/motor control and system monitoring at the Sutter Maintenance Yard for each of the pumping plants.

E. Each pumping plant shall have a local Human Machine Interface (HMI) which shows data and alarms for the associated pumping plant. Information Displayed on the Pumping Plant HMI shall be similar in layout and format as that displayed on the SCADA Workstation at the Sutter Maintenance Yard.

F. The SCADA System shall provide real time and historical data, alarms, trends, and statistics for the following equipment:

1. Level sensors as described in Section 13420 – Level Sensors.
2. Switchgear and associated equipment described in Section 16430 – Metal-Enclosed Switchgear.
3. Diesel Engine Generator (SEG) and associated equipment described in Section 16230 – Standby Engine Generator.
4. Automatic Transfer Switch (ATS) and associated equipment described in Section 16415 – Switches and Load Banks.
5. Uninterruptible Power Supply (UPS) as specified in Section 16720 – Communications System and herein.
6. As shown.

G. SCADA System Software architecture shall be such that integration of future pumping plants (control and monitoring) can be facilitated by adding to the existing software. It is estimated that two additional facilities will be added in the future.

H. SCADA System Hardware architecture shall be such that integration of new hardware can be facilitated by adding to the existing hardware. Future hardware may include:

1. Video Interface Cards.
2. Internal Hard Drives.
3. Monitors.
4. SCADA Server.
5. Historical Data System.
6. Random Access Memory.
7. SCADA Workstation.

PART 2 PRODUCTS

2.01 SCADA WORKSTATION

A. The SCADA Workstation shall be the main View Node used for monitoring and control of the pumping plants by the plant operator. The SCADA Workstation shall include the following at minimum:

1. Dual Quad Core Intel Xeon Processors X5560 2.8GHz.
2. 4GB of DDR3 RDIMM Memory at 1333 MHz.
3. Video Card: 512MB NVIDIA Quadro NVS 420, Quad Monitor.
4. Boot Hard Drive: 1 TB SATA 3.0Gb/s, 7200 RPM Hard Drive with 16MB Cache.
5. Additional Hard Drives: Enclosure shall have capability for installation of up to three additional hard drives.
6. 16X DVD+/-RW Drive.
7. 10/100/1000 Gigabit Ethernet controller-PCI Express card.
8. Data/Fax PCI Modem.
9. USB Keyboard and Laser Mouse with mouse pad.
10. Sound Card and External Soundbar Speakers.
11. Four Widescreen Monitors:
    a. 22 inch, diagonal size.
    b. TFT Active Matrix LCD Type.
    c. Dot Pitch of 0.280 mm or better.
    d. 1680 x 1050 minimum resolution.
    e. 24-bit color support.
    f. 300 cd/m^2 Luminance, minimum.
    g. 1000:1 contrast ratio, minimum.
    h. 178 degree horizontal and vertical viewing angles.
    i. VGA and DVI-D inputs.

12. Monitor Mount including the following:

    a. Dual Tiered, two over two.

    b. Wall Mount, Grommet Mount, Flush Mount as approved.

    c. Up to 30 inch display accommodation.

    d. Scalable with interchangeable parts.

    e. Tool-less quick release design.

    f. Portrait, Landscape, or combination monitor mounting capability.

    g. Monitor Tiling Capability.

    h. Expandable to support up to 5 over 5 monitors.

    i. Pivots 20 degrees up and 10 degrees down for each monitor.

    j. Six inch vertical adjustment capability.

    k. Support for monitors up to 25 lbs. each.

    l. Tamper-proof pivot.

    m. Arm Articulation.

    n. VESA Compatibility, 75 mm and 100 mm.

    o. Include additional parts required for 6 (three over three) and 8 (four over four) monitor configurations.

    p. Monitor mount shall be as approved.

13. Uninterruptible Power Supply (UPS):

    a. Output Power Capacity: 1200 W, 1500 VA.

    b. 95 percent efficiency.

    c. Output connectors: Eight NEMA 5-15R.

    d. 30 minute run time.

    e. 120 Vac Input.

    f. 120Vac Output.

g. Tower Mount.

h. Interface Ports:

1) RS-232.

2) RJ-45 10/100 Base-T.

3) USB.

i. LED status display with load and battery bar-graphs and On Line, On Battery, Replace Battery, Overload and Bypass Indicators.

j. Distinctive Audible Alarms:

1) Alarm when on battery.

2) Low battery alarm.

k. Surge Energy Rating of 550 Joules.

l. Full time multi-pole noise filtering.

m. Additional Battery Pack.

n. UPS shall be APC, SMX1500RM2UNC; General Electric, GT Series UPS16170; or equal.

14. Resource DVD with Quick Reference Guide. Resource DVD shall have Diagnostic Tools and Drivers.

15. Microsoft Windows XP Professional, Service Pack 3.

16. Operating System Restore Discs and Resources Disc.

17. Microsoft Office Professional, latest version.

18. Adobe Acrobat Pro, latest version.

19. SCADA System Software.

B. The SCADA Workstation shall be DELL, Precision T7500 Series; IBM, IntelliStation; or equal.

C. SCADA Workstation shall include accessories, cables, hardware, and appurtenances.

2.02 LAPTOP COMPUTER

A. The SCADA System shall include a Laptop computer which shall be used for bidirectional communication with the PLCs, NMFRs, Intelligent Servers, Satellite Synchronized Clocks (SSCs), HMIs, Diesel Engine Generators, and Automatic Transfer Switches (ATS), for troubleshooting, uploading settings and programming, downloading data, monitoring and control. The Laptop Computer shall include to the following at minimum:

B. The Laptop computer shall include the following at minimum:

1. Intel Core 2 Duo T9900, 3.06GHz, 6M L2 Cache, 1066MHz FSB.
2. 15" UltraSharp WUXGA, CCFL Display with 1920 x 1200 resolution.
3. NVIDIA Quadro FX 770M, 512MB.
4. 4 GB, DDR2-800 SDRAM, 2 DIMMS.
5. 500GB, 7200 RPM Hard Drive.
6. DVD Drive: 8X DVD+/-RW.
7. Backlit Keyboard.
8. 9 Cell Battery including spare.
9. AC Power Adapter.
10. Bluetooth Module.
11. Internal 56K Modem.
12. Bluetooth Wireless Mouse.
13. RS-232 to USB adapter cables for NMFRs, PLCs, SSCs, and Intelligent Servers. The adapter cable shall be from the same manufacturer as the NMFRs, PLCs, SSCs, and Intelligent Servers specified in Section 16430 – Metal-Enclosed Switchgear.
14. Carrying Case: Shall be a hard case and shall include the following:
    a. Foam interior.
    b. Watertight, crushproof, and dust proof.

c. Resistant to UV light, solvents, corrosion, fungus.

d. Overmolded handle.

e. Double Throw latches.

f. Automatic Ambient Pressure Equalization Valve.

g. Stainless steel padlock protectors.

h. Nylon padded computer sleeve and accessories pouch.

i. Lid organizer.

j. Shock absorbing tray.

k. Padded shoulder strap.

l. Color: Black.

m. Carrying case shall be Pelican Case, 1495CC#1; SKB Case, 3I-1813-5B-N; or equal.

15. Resource DVD with Quick Reference Guide. Resource DVD shall have Diagnostic Tools and Drivers.

16. Microsoft Windows XP Professional, Service Pack 3.

17. Operating System Restore Discs and Resources Disc.

18. Microsoft Office Professional, latest version.

19. Adobe Acrobat Pro, latest version.

20. Back-up and Recovery Manager.

21. SCADA System Software.

22. NMFR, PLC, SSC, Intelligent Server, HMI, Diesel Engine Generator, ATS, and Communications System Software. The Software shall include:

    a. Diagnostic Software.

    b. Programming and Settings Software.

    c. Network and Communications Diagnostic Software.

C. The Laptop shall be DELL Precision Mobile, M4400 Series; Apple, MacBook Pro 17; or equal.

D. Laptop computer shall include accessories, cables, hardware, and appurtenances.

2.03 SCADA SERVER

A. The SCADA Server shall be the hub of the SCADA System designed with a fully distributed Client/Server Architecture for maximum processing power. The SCADA Server shall retrieve remote I/O information from the pumping plants connected to the system, pass control information to the pumping plants connected to the system, maintain a centralized real-time and historical database, and serve the information to Clients that are properly logged into the system. The SCADA Server shall have clients at the following sites:

1. Department of Water Resources – Sutter Maintenance Yard.

2. Department of Water Resources – Joint Operations Center.

B. Each site shall have more than one client. The number of clients is to be determined.

C. The SCADA Server shall be a redundant solution of two SCADA Servers consisting of a primary and a backup server.

D. The redundant SCADA Servers shall employ SCADA Failover. SCADA Failover shall increases the availability of data to the View node and minimizes the amount of time that data is unavailable by allowing the View node to connect to more than one SCADA Server. Through recognition of multiple paths to the data, a switch can be made from one path to another automatically, improving overall system availability for critical operations.

E. Each SCADA Server shall include the following at minimum:

1. Chassis for up to six 3.5 Inch Hard Drives.

2. Dual 2.8Ghz Intel Xeon X5560 with 8M Cache, Turbo Boost , Hyper-Threading and 1333MHz memory speeds.

3. 12GB RAM, 1333MHz Dual Ranked RDIMMs for 2 Processors, Optimized.

4. Two 600GB Hard Drive Sets:

a. RAID 1.

b. 10,000 RPM.

c. Serial-Attached SCSI.

d. 6Gbps.

e. 3.5in Hotplug Hard Drive.

5. RAID Controller with 512MB Cache and 6 Gb/s SAS interface.
6. Redundant Power Supply, High Output, 850W.
7. Enterprise Remote Access Controller.
8. Dual two port 1GbE Network Interface Card with TCP/IP Offload Engine and iSCSI Hot Bus Adapter.
9. Sliding Ready Rails With Cable Management Arm.
10. Bezel.
11. Internal SATA DVD+/-RW.
12. USB keyboard and laser mouse.
13. Electronic System Documentation, OpenManage DVD Kit with DMC.
14. SCADA System Software.
15. Uninterruptible Power Supply:

    a. Output Power Capacity: 2850W, 3000 VA.

    b. 95 percent efficiency.

    c. Output connectors: Six NEMA 5-15R and two NEMA 5-20R.

    d. 30 minute run time.

    e. 120 Vac Input.

    f. 120Vac Output.

    g. 3U Rack Mount.

    h. Interface Ports:

        1) RS-232.

2) RJ-45 10/100 Base-T.

3) USB.

i. LED status display with load and battery bar-graphs and On Line, On Battery, Replace Battery, Overload and Bypass Indicators.

j. Distinctive Audible Alarms:

1) Alarm when on battery.

2) Low battery alarm.

k. Surge Energy Rating of 550 Joules.

l. Full time multi-pole noise filtering.

m. Additional Battery Pack.

n. Spare Battery Packs and manufacturer recommended spare parts.

o. UPS shall be APC, SUM3000RMXL2U; General Electric, GT Series UPS16168; or equal.

16. SCADA Server shall include accessories, cables, hardware, and appurtenances.

17. Enterprise level server software shall be provided as required and is subject to approval. The following software may be required for proper operation and functionality of the HDS Server and shall be considered as minimum:

a. Windows Server 2008 SP2, Enterprise Edition.

b. Microsoft SQL Server 2008.

c. Windows Essential Business Server 2008 User Client Access Licenses (CALs), Five Premium and Five Standard.

d. VMware Virtualization.

18. The SCADA Server shall be DELL PowerEdge R710 Series; HP ProLiant DL585G5 – VMware ESX v3.5.0 Update 3; IBM System x3850 M2 – VMware ESX v3.5.0 Update 3; or equal.

2.04 HISTORICAL DATA SYSTEM (HDS) SERVER

A. The HDS Server shall control the creation, maintenance, and the use of the database of historical data. Historical Data shall be stored on the HDS Server.

B. The HDS Server shall store the information collected from Pumping Plant field devices such as PLCs, NMFRs, SSCs, Intelligent Servers, Diesel Engine Generators, Automatic Transfer Switches, Level Sensors, CDEC water level measurement equipment, UPSs, and Communications Equipment.

C. The HDS Server shall be capable of sending historical data for view at the Main View Node and the Client Nodes.

D. The HDS Server shall include the following at minimum:

1. Chassis for up to six 3.5 Inch Hard Drives.

2. 2.8Ghz Intel Xeon X5560 with 8M Cache, Turbo Boost , Hyper-Threading and 1333MHz memory speeds.

3. 12GB RAM, 1333MHz Dual Ranked RDIMMs for one Processor, Optimized.

4. Two 2TB Hard Drive Sets:

   a. RAID 1.

   b. 7200 RPM.

   c. 3.5in Hotplug Hard Drive.

5. RAID Controller with 512MB Cache and 6 Gb/s SAS interface.

6. SAS External RAID Adapter, 512MB.

7. Direct Attached Storage (DAS): Direct Attached Storage shall be from the same manufacturer as the HDS Server and shall have the following, minimum:

   a. Two Enclosure Management Modules.

   b. Two 2TB 7200 RPM Universal SATA 3.5in Hot Plug Hard Drives, RAID 1 (four drives).

   c. Hard Drive Filler Blanks for unused hard drive bays.

d. Direct Attached Storage (DAS) shall be DELL, PowerVault MD1000; or equal.

8. Redundant Power Supply, High Output, 850W.

9. Dual two port 1GbE Network Interface Card with TCP/IP Offload Engine and iSCSI Hot Bus Adapter.

10. Sliding Rails With Cable Management Arm.

11. Bezel.

12. Internal SATA DVD+/-RW.

13. Electronic System Documentation, OpenManage DVD Kit with DMC.

14. SCADA System Software.

15. Uninterruptible Power Supply:

    a. HDS Server shall operate from the UPS specified in Paragraph 2.03 E.

16. HDS Server shall include accessories, cables, hardware, and appurtenances.

17. Enterprise level server software shall be provided as required and is subject to approval. The following software may be required for proper operation and functionality of the HDS Server and shall be considered as minimum:

    a. Windows Server 2008 SP2, Enterprise Edition.

    b. Microsoft SQL Server 2008.

    c. Windows Essential Business Server 2008 User Client Access Licenses (CALs), Five Premium and Five Standard.

    d. VMware Virtualization.

18. The SCADA Server shall be DELL PowerEdge R710 Series; or equal.

2.05 SCADA SYSTEM SOFTWARE

A. General: The central computer software shall provide the user interface to perform all graphic display presentation, plant control, alarm reporting and background tasks. The SCADA System shall

communicate directly with the remote sites unless otherwise noted. The Contractor shall be responsible for the integration of the SCADA, Intelligent Servers, PLCs, Communications System, and associated devices.

B. The system software shall have a Graphical User Interface (GUI) to provide an animated graphic display representation of each pumping plant. The system software shall be capable of displaying the information available from each device at each pumping plant. The software shall maximize the information capabilities of the connected devices in totality and shall be capable of displaying them in real time. Real time data shall be available in SQL format such that the data can be queried by any ODBC-compliant application. Information to be provided shall be as specified and as shown to include but not be limited to:

1. Equipment Status.
2. Equipment, Fault and Water Level Alarms.
3. Sequential Events Recorder (SER) Report.
4. Event Reports.
5. Real Time Trending.
    a. Starting.
    b. Running.
    c. Shutdown.
    d. Water Level.
6. Real Time Metering.
7. Metering Statistics.
8. Load Profiling.
9. Operating Statistics.
10. Starting Reports.
11. Trending Reports.

C. The software shall also be capable of performing the following background tasks:

1. Report generation.

2. Data archiving.

3. Historical Data Access.

4. Data base maintenance.

D. The SCADA System software shall be Wonderware, InTouch; Areva, e-terracontrol; GE Fanuc, Proficy HMI/SCADA - iFIX; or equal.

E. The SCADA System shall utilize the DNP3 protocol to communicate directly with the remote sites.

1. The SCADA System communications driver shall use DNP3 protocol to communicate with the following Devices as specified, as shown, and as required to meet the design intent:

a. Communications System.

b. Intelligent Servers.

c. PLCs.

d. NMFRs.

e. Diesel Engine Generators.

f. ATSs.

g. Battery Chargers.

F. Screens: Graphical depiction shall include a rendering of the site encompassing each of the field parameters that are being monitored.

1. Graphical Depiction shall include, but not limited to, pertinent physical items such as:

a. Pumps.

b. Motors.

c. Metal-Enclosed Switchgear.

d. NMFRs.

e. Deisel Engine Generators.

f. ATSs.

g. Battery Banks.

h. Meters.

i. Associated equipment.

2. The system shall be capable of displaying each Pumping Plant on a dedicated monitor such that all pumping plants can be monitored simultaneously.

3. Each work site screen shall be navigable from the main overview screen via point-and-click functionality built in.

4. Other screen types shall be Control, Communications Status, Alarm Summary, Runtime Manager, Trends, Reports, SER, and water levels.

5. Analog values shall be displayed in U.S. customary units and shall be formatted in engineering notation for numbers greater than 1000 and numbers less than 1.

6. Status points shall be displayed as ON/OFF and color coded as approved.

G. Reports: Process data reports shall consist of minimum, maximum, and average values on an hourly, daily, weekly, and monthly basis for all pertinent analog values at each work site. The following shall also be included:

1. Reports shall include a Date and Time Stamp.

2. Load Profiling Reports shall be available in 5, 10, 15, 30, and 60 minute intervals and shall be configurable on screen.

a. Shall be capable of choosing the quantities to report from a list of available analog quantities.

3. Operating Statistics Reports shall be available in 6 hour increments, minimum. Other device increments available shall also be included.

4. Motor Start Reports shall be available as a Summary, Start Data, or both.

5. Motor Start Trending Reports shall be available in 30 day intervals.

6. Event Reports shall be available in 15, 30, 60 and 120 or 15 and 64 cycle intervals, depending on the NMFR. Prefault Intervals shall be 1-10 cycles for 15 cycle reports and 1-59 cycles for 64 cycle reports. Each cycle shall have 12, 16, or 24 samples. Event Reports shall include but not be limited to:

   a. Sampled Analog Inputs.

   b. Input and Output Status.

   c. State of NMFR elements and logic.

   d. Relay settings.

   e. Event Type.

   f. Fault Location.

   g. Maximum Current.

   h. Oscillographs.

   i. Phasor Plots.

7. SER Report: Each Report shall include the latest 1024 state changes of a relay element and shall compliment the event reports.

8. Water levels shall be archived in the SCADA System's historical database and displayed in printed report format. Mechanical and maintenance data such as pump run time and number of starts shall also be archived in the historical database and displayed in printed report format. The Contractor shall provide report templates and shall be as approved.

H. Trends: Analog points shall be trended on an independent trend screen per site. Historical and real-time trends shall be provided for each analog point. Each variable per screen shall be color coded independently from the other "pen" lines on the graph. The operator shall be able to zoom in and zoom out on any part of the trend for ease of reading. A cursor function shall be included which allows the operator to select a given point on the trend and receive information on the value of the trend at that point. The operator shall be given the ability to scroll forward and backward through the allotted time on any given trend.

I. Alarms: SCADA alarming software shall be configured for notification of field, communications, and system alarms.

1. Provide high, low, equipment fail, instrument fail, NMFR fail, breaker fail, electrical fault, mechanical malfunction, High Water Level, High Water Level Rate of Change (increase) alarms for all digital and analog points in the system.

2. Provide communications system fail alarms.

3. Whenever an analog point exceeds its associated alarm limit, or discreet point changes to an alarm state, an alarm message shall be stored to the historical database. The alarm message shall include time, date, tag number, and alarm status.

4. When the operator acknowledges alarms, the alarm message shall be stored to the database. A selectable option shall require identification of the current operator to acknowledge the alarm, with attending space for typed comments to be added to each alarm.

5. When the alarm point returns to its normal range, the alarm message shall be stored to the database.

6. A pop-up alarm status screen shall list all currently outstanding (unacknowledged) alarm and control conditions. Offline review of raw alarm logs shall be possible using log files with each data entry identified by date and time stamp. To facilitate alarm log review and analysis, the log files shall be sortable by criticality using as many as six levels, and by eight functional type categories, as well as by date and time of occurrence.

7. The SCADA System shall be capable of recalling any past alarm event.

8. A page, text message, and/or email shall be sent to Sutter Maintenance Yard personnel upon certain alarm conditions. The alarm conditions upon which personnel are notified shall be configurable as well as the quantity of personnel and the method of contact.

J. System Database: Field data collected shall be stored to a Historical Data Server (HDS) that resides on the Ethernet network. This architecture shall be used for dedicated data handling to avoid impedance of the SCADA Server in its system control and data collection tasks. Real-time and historical data shall be available in true SQL format such that data can be queried by any ODBC-compliant application.

1. Historical database access shall be password protected. Access to the server upon which the data is maintained shall be denied without the proper password and PIN number.

2. Access to the data itself shall be protected with another layer of password protection. Protection of data is secure from intentional outside intervention.

3. No one shall be given write access to the database engine except for those authorized in very unusual maintenance circumstance.

4. Historical data integrity shall be maintained by archiving each day's, week's and month's data onto one or more storage media. The primary virtue of SCADA System data backup shall be the retention of historical information.

5. This historical data shall be accessible to generate detailed reports on pump and motor operation, metering, trends, SER, water levels and other associated data as approved. The data for those reports shall be made available on a type of storage medium that will deliver easy, fast, non-sequential data access. For efficient facilitation of data retrieval, 10 years worth of data shall be inquired and readily available on the hard drive. The database application shall perform several functions automatically. These functions are as follows:

   a. Automatic data replication.

   b. Automatic data compression w/ generation of min., max., and avg. data tables for every analog variable collected.

   c. Automatic data synchronization.

   d. Automatic data links to Microsoft's Access and Excel.

6. The Historical Data System (HDS) shall integrate seamlessly with the redundant, hot-standby SCADA Servers. The SCADA application software shall have the ability to log all data and events directly to the HDS system without requiring conversions of any kind.

7. The database application shall monitor the LAN and/or WAN connections between the actual SCADA Server and the HDS. In the event that the LAN connection is lost between the primary and/or secondary SCADA Server and the HDS, the SCADA Server shall log data locally on its respective local HDD. As soon as the connection is reestablished, the system shall handle all database synchronization automatically.

8. A front-end animated GUI application shall be supplied to allow the operators direct access to all of the database application data. This GUI shall provide a complete set of automated scripts and stored procedures that allow MS-Access and Excel direct and automated access to the SQL database engine.

9. Programmable function blocks shall be supplied that automatically insert data arrays into a MS-Access or Excel application. These data arrays shall consist of the analog and digital points in the compressed SQL data tables. The GUI shall also allow direct and seamless interface between the analog trending package and the SQL database engine.

K. Software shall be provided for the pumping plant Touchscreen HMIs provided under Section 16430 – Metal-Enclosed Switchgear that:

1. Is similar in function and look as the SCADA System software for SMY.

2. Displays real-time data for the associated pumping plant including but not limited to:

   a. Equipment Status.

   b. Statistics.

   c. Trends.

   d. SER Reports.

   e. Event Reports.

   f. Water Levels for pumping plant and for CDEC.

3. Provide control point for Diesel Engine Generator and ATS.

4. Display Historical Data for the past seven days.

5. Display current alarms and alarms for the past seven days including both acknowledged and unacknowledged alarms.

L. The SCADA System Software is subject to approval.

M. The SCADA Systems Integrator shall be TESCO Controls Inc.; EMCOR Services – Fluidics; or equal.

2.06 ENTERPRISE NETWORK PRINTER

A. General: The Enterprise Printer shall be used for the printing of reports and shall be available to all computers in the new control building at the SMY shown.

B. The Enterprise Printer shall have the following features:

1. Color Laser Print Technology.
2. Black Print Resolution of 2400 dpi.
3. Color Print Resolution of 2400 dpi.
4. Print Speed (black, letter) of up to 45 ppm.
5. Print Speed (color, letter) of up to 40 ppm.
6. Print Speed (black, letter, duplex) of up to 37 spm.
7. Print Speed (color, letter, duplex) of up to 32 spm.
8. Time to first page (black) as fast as 5 sec.
9. Time to first page (color) as fast as 9 sec.
10. 1024 MB Memory, minimum.
11. Printable area of within 0.158 in. of the top, bottom, left, and right edges.
12. 1 GHz Processor Speed, minimum.
13. Hard Drive included.
14. 200,000 page monthly duty cycle.
15. Integrated Duplexing, 100-sheet multipurpose feeder, and three 500-sheet input trays.
16. Supported Media Sizes:

    a. 10 Envelope.

b. A3.

c. A4.

d. A5.

e. C5 Envelope.

f. DL Envelope.

g. Executive.

h. Folio.

i. JIS-B4.

j. JIS-B5.

k. Ledger.

l. Legal.

m. Letter.

n. Statement.

o. Universal.

17. Supported Media Types:

    a. Card Stock.

    b. Envelopes.

    c. Glossy Paper.

    d. Paper Labels.

    e. Plain Paper.

    f. Transparencies.

18. Supported Operating Systems, minimum:

    a. Microsoft Windows: Windows 2000, Windows NT, Windows XP, Windows Vista and Windows 7.

    b. Microsoft Windows Server: Windows Server NT, Windows Server 2000, Windows Server 2003, Windows Server 2008.

19. Included Ports:
    a. Internal Card Slot.
    b. USB Direct interface on Operator Panel.
    c. Gigabit Ethernet (10/100/1000BASE-T).
    d. Hi-Speed USB.
    e. Internal RS-232C serial.
    f. Internal 1284-B Bidirectional Parallel.
20. Additional Network Ports:
    a. 802.11g Wireless Print Server.
    b. Fiber Fast Ethernet.
21. Printer Languages:
    a. PCL 5c Emulation.
    b. PCL 6 Emulation.
    c. Personal Printer Data Stream (PPDS).
    d. PostScript 3 Emulation.
    e. xHTML.
    f. PDF 1.6.
    g. Direct Image.
22. Network Protocol Support:
    a. TCP/IP IPv4.
    b. IPX/SPX.
    c. AppleTalk.
    d. LexLink (DLC).
    e. TCP/IP IPv6.
23. Accessories: 3-Hole Finisher and Gigabit Ethernet Print Server.

C. The Enterprise Network Printer shall be Lexmark, C935hdn; Hewlett-Packard, CP6015xh; or equal.

2.07 ACCESSORIES

A. Ethernet Cables:

1. The Ethernet cables shall be LANmark-2000 CAT 6, 4 twisted pair cable; or equal.

2. The Ethernet cables shall be FEP insulated, 500 MHz, category 6 plenum cables. The high performance category 6 cables shall have a flexible aluminum tape shield with a tin coated, stranded copper drain wire for easy grounding.

3. The construction of the cable shall meet the requirements for installation that may be subjected to higher than normal external electromagnetic noise sources, attenuation, structural return loss and attenuation-to-crosstails rating (ACR).

4. The Ethernet cables shall be able to support the most sophisticated network protocols.

5. The Ethernet cables shall be 4 pair 24 AWG solid bare copper with thermoplastic insulation, ripcord, polymer alloy jacket, plenum rated.

B. The SCADA Workstation, SCADA Server, and HDS Server shall be connected to a Keyboard-Video-Mouse (KVM) Switch. This switch shall allow up to (4) computers to share a common keyboard monitor(s), and mouse. The KVM Switch shall be Rose Electronics Multi Video, Model #MPB-4U2V; Belkin SOHO, Model #F1DH104L; or equal.

1. Cables, hardware and appurtenances shall be provided and shall be by the same manufacturer as the KVM switch.

C. Software shall be provided on CD/DVD and shall be from the software manufacturer. No software duplications on CD±R, CD±RW, DVD±R, or DVD±RW shall be accepted.

D. The SCADA System shall include all cables, accessories, hardware, and appurtenances required to meet the design intent.

E. The SCADA System shall include manufacturer recommended spare parts.

PART 3 EXECUTION

3.01 INSTALLATION AND CONFIGURATION

A. General: The Contractor shall be responsible for field measurements and surveys required for the installation of the SCADA System at the Sutter Maintenance Yard and the three Pumping Plants. The Contractor shall submit detailed drawings showing the proposed installation and shall include existing equipment. Drawing submittals shall be in accordance with Paragraph 1.04 and Section 01330 – Submittals.

B. SCADA Workstation:

1. The SCADA Workstation and associated UPS shall be installed as shown and as approved.

2. Monitors shall be installed two over two as approved and connected to the workstation tower.

3. The SCADA Workstation shall be connected to the redundant SCADA Servers by Ethernet Category 6 cable. Cable installation shall be as approved.

4. The SCADA Workstation shall be connected to the Department Furnished Analog Modem as required.

5. The SCADA Workstation shall be connected to the local printer/printer network and the printer driver(s) shall be installed and made accessible to operators. Printers shall be used for report generation.

6. Software for the SCADA Workstation shall be loaded and configured prior to installation at the SMY, including licensing.

C. Laptop Computer:

1. Software including licensing shall be installed and configured on the Laptop.

2. The Laptop shall be installed in the case specified including all accessories, hardware, and appurtenances.

D. SCADA Server:

1. The SCADA Servers and associated UPS shall be installed in the new Sutter Maintenance Yard control building shown in the existing equipment rack as approved.

2. Server software shall be loaded onto each server and configured, including licensing, for optimum SCADA System performance.

3. The SCADA Server shall be connected to the Communications System, SCADA Workstation and HDS by Ethernet Category 6 cable. Cable installation shall be as approved.

4. Install and configure connections required for transfer of Water Level Data to CDEC. Connections shall be as approved.

5. Install and configure connections required for transfer of Historical Data from the SCADA System to the Joint Operations Center (JOC) Client.

6. Make internal network connections as specified, as required and as directed.

E. Historical Data System Server

1. The HDS Server and associated UPS shall be installed in the new Sutter Maintenance Yard control building shown in the existing equipment rack as approved.

2. HDS Server software including licensing shall be loaded onto each server and configured for optimum SCADA System performance.

3. The HDS Server shall be connected to the SCADA Server by Ethernet Category 6 cable. Cable installation shall be as approved.

F. SCADA System Software:

1. SCADA System Software and other associated software including licensing shall be installed and configured as required and as approved to meet the design intent for equipment including but not limited to:

   a. PLCs.

   b. Intelligent Servers.

   c. HMI Touchscreens.

   d. SCADA Workstation.

   e. SCADA Servers.

   f. HDS Server.

G. Touchscreen HMI software shall be installed as required in accordance with the software and equipment manufactaurer's recommendations.

H. The Enterprise Network Printer shall be installed in the SMY Control Building in a location as directed. The printer shall be configured such that prints may be made from any Department server, workstation, or PC within the building. The printer network shall be secured as to only allow prints to be made from Department authorized computers.

I. Accessories shall be installed as required in accordance with manufacturer recommendation and as approved.

3.02 TESTING

A. Shop Tests, Commissioning and Field Acceptance Tests:

B. The Contractor shall notify the Engineer in writing a minimum of 14 days prior to testing.

C. Perform SCADA system test of the following but not limited to:

1. Wiring Check.
2. Point to Point Tests.
3. Screen Navigation.
4. Remote Motor and Pump Control.
5. Remote Diesel Engine Generator Control and Scheduling.
6. Remote ATS Control.
7. Simulated faults and alarms.
8. Alarm Notifications.
9. Event reporting.
10. SER reporting.
11. Trending and Statistics.
12. Remote telemetry of Pumping Plants.
13. Automatic reboot of system due to power failure.

D. The Contractor shall originate and develop a test plan for the following tests:

1. Shop Tests.

2. Commissioning Tests.

3. Site Acceptance Tests.

E. Test plans are subject to approval.

PART 4 PAYMENT

4.01 PAYMENT

A. The contract price will be paid for SCADA SYSTEM; which price shall include full compensation for all costs incurred under this section.

END OF SECTION